Creating PyTorch Solutions on Azure

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Overview

Azure Machine Learning Service

Azure notebooks for PyTorch

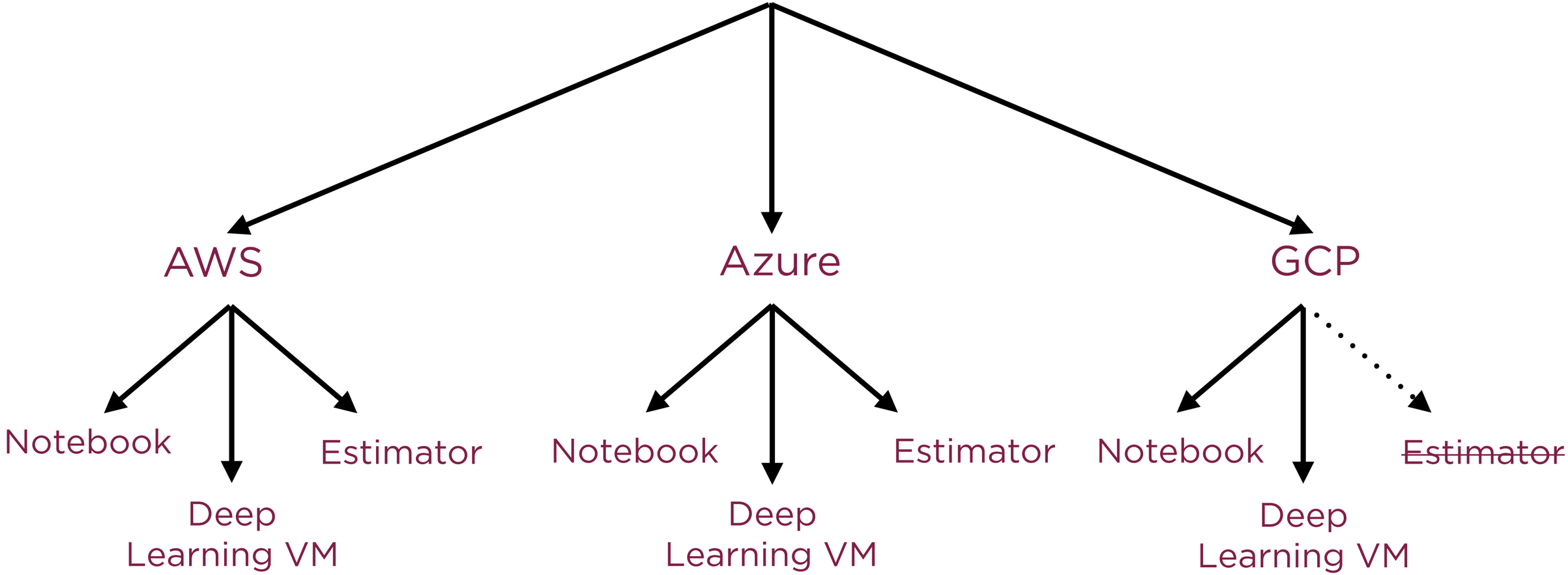
PyTorch estimators on Azure

Leverage Horovod for distributed deep learning

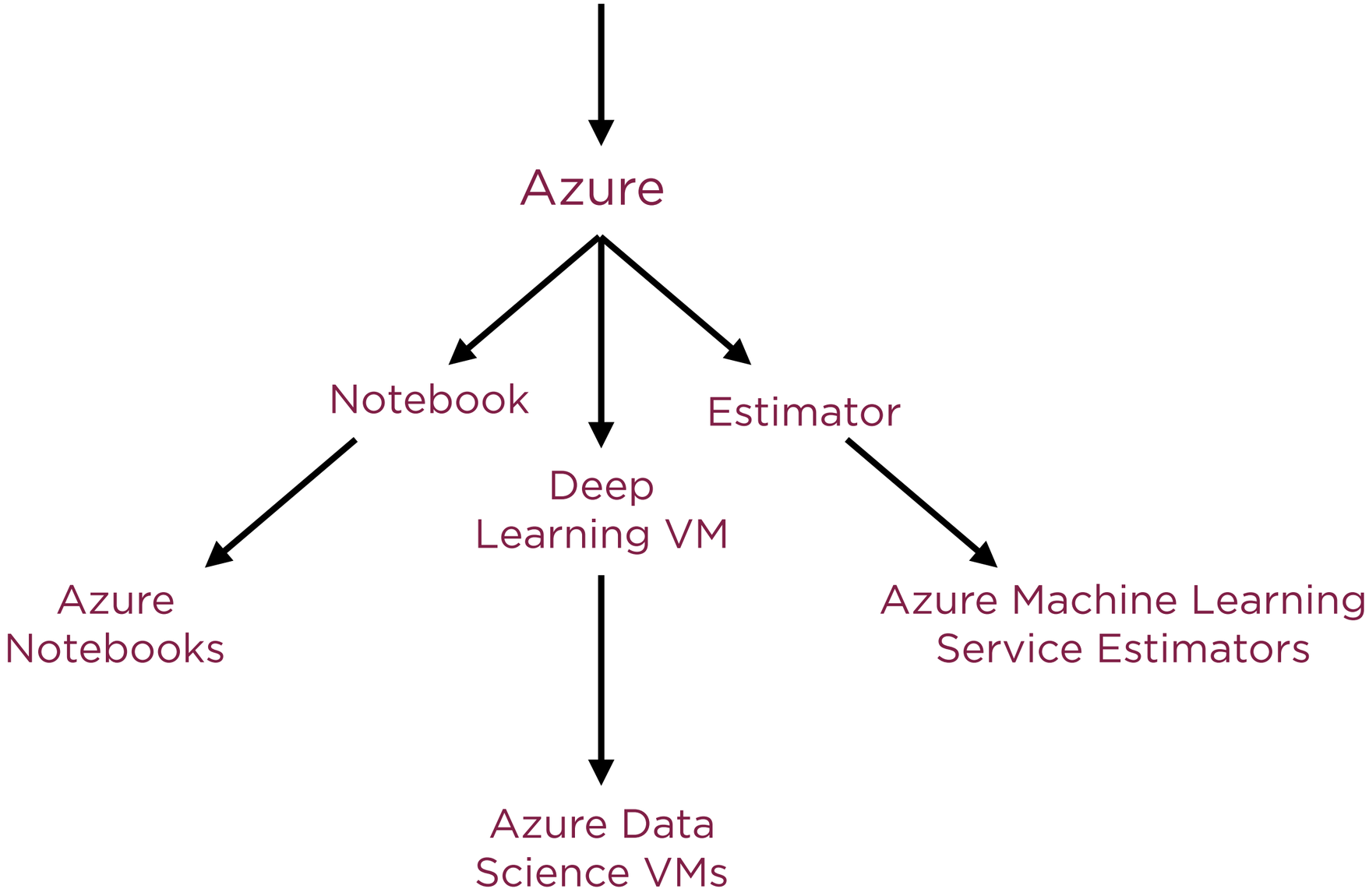
Azure Deep Learning VMs

Machine Learning in Azure

PyTorch on the Cloud



PyTorch on the Cloud



Azure Machine Learning Service

Cloud service to train, deploy, automate and manage machine learning models

Supports open-source technologies such as PyTorch, TensorFlow and scikit-learn

Azure Machine Learning Service

Build custom models using open-source frameworks

Run distributed training

Perform hyperparameter tuning

Deploy models

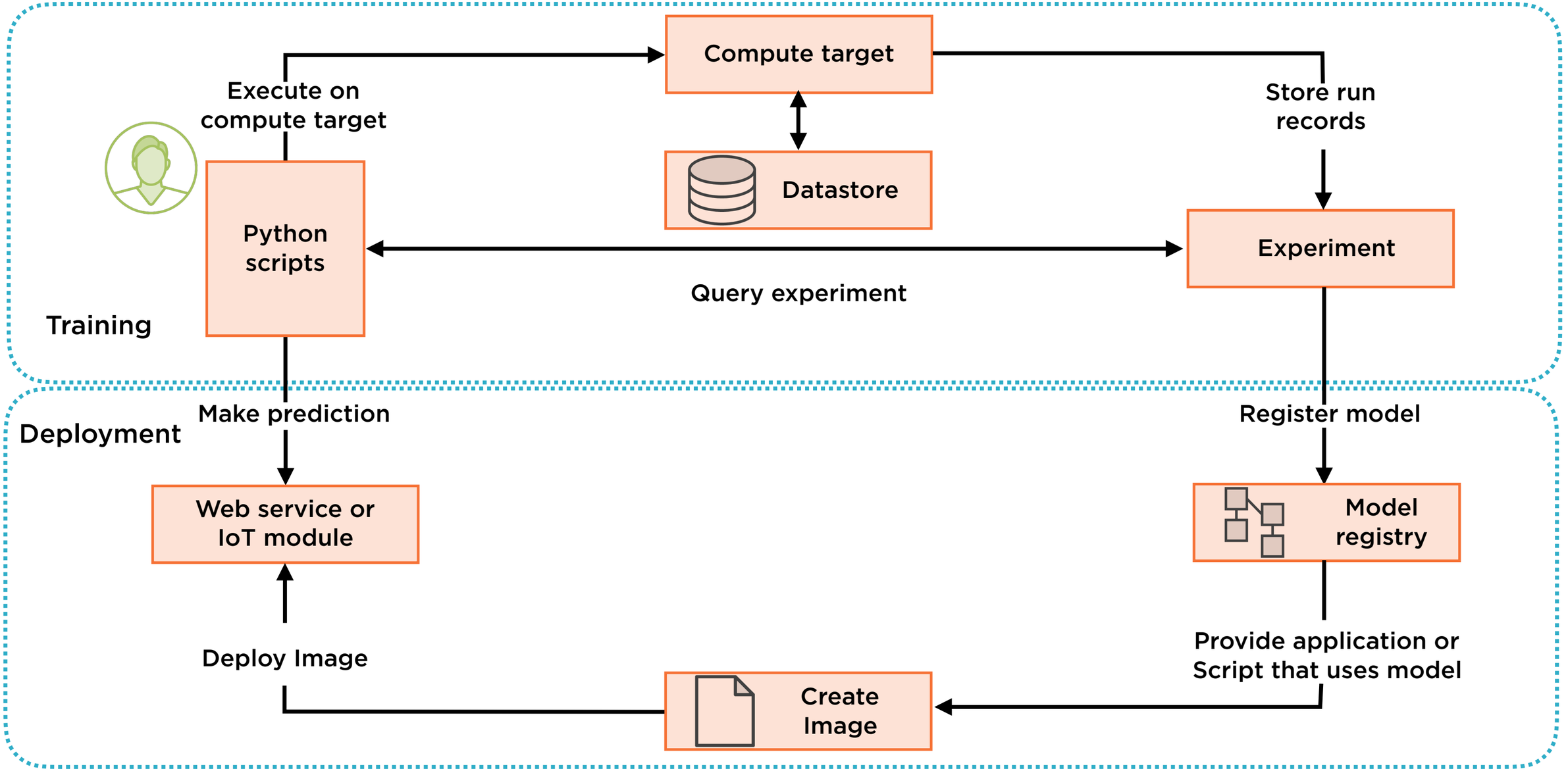
Use models for prediction

Demo

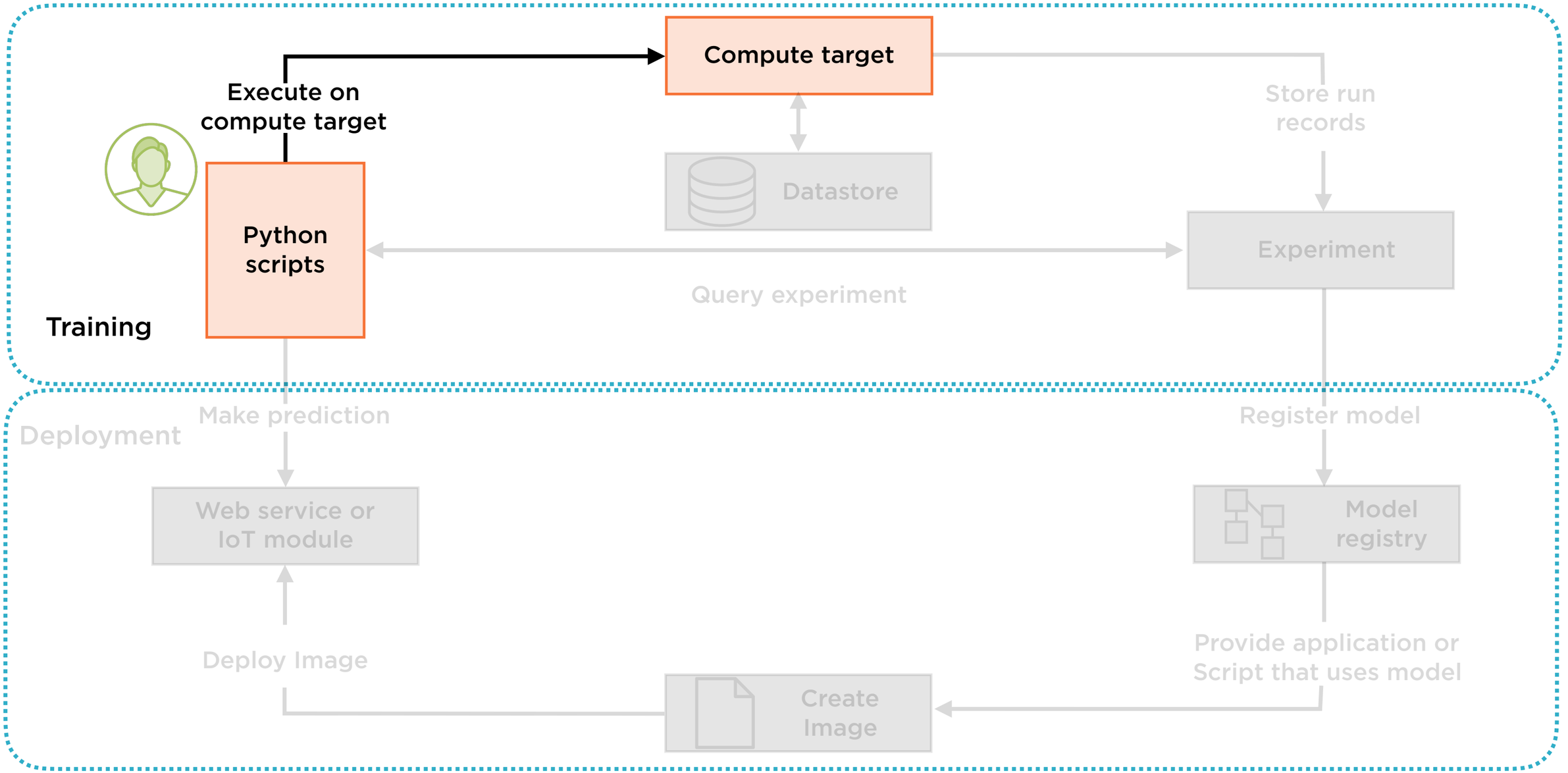
Prototyping PyTorch models on Azure notebooks

Azure Machine Learning Service

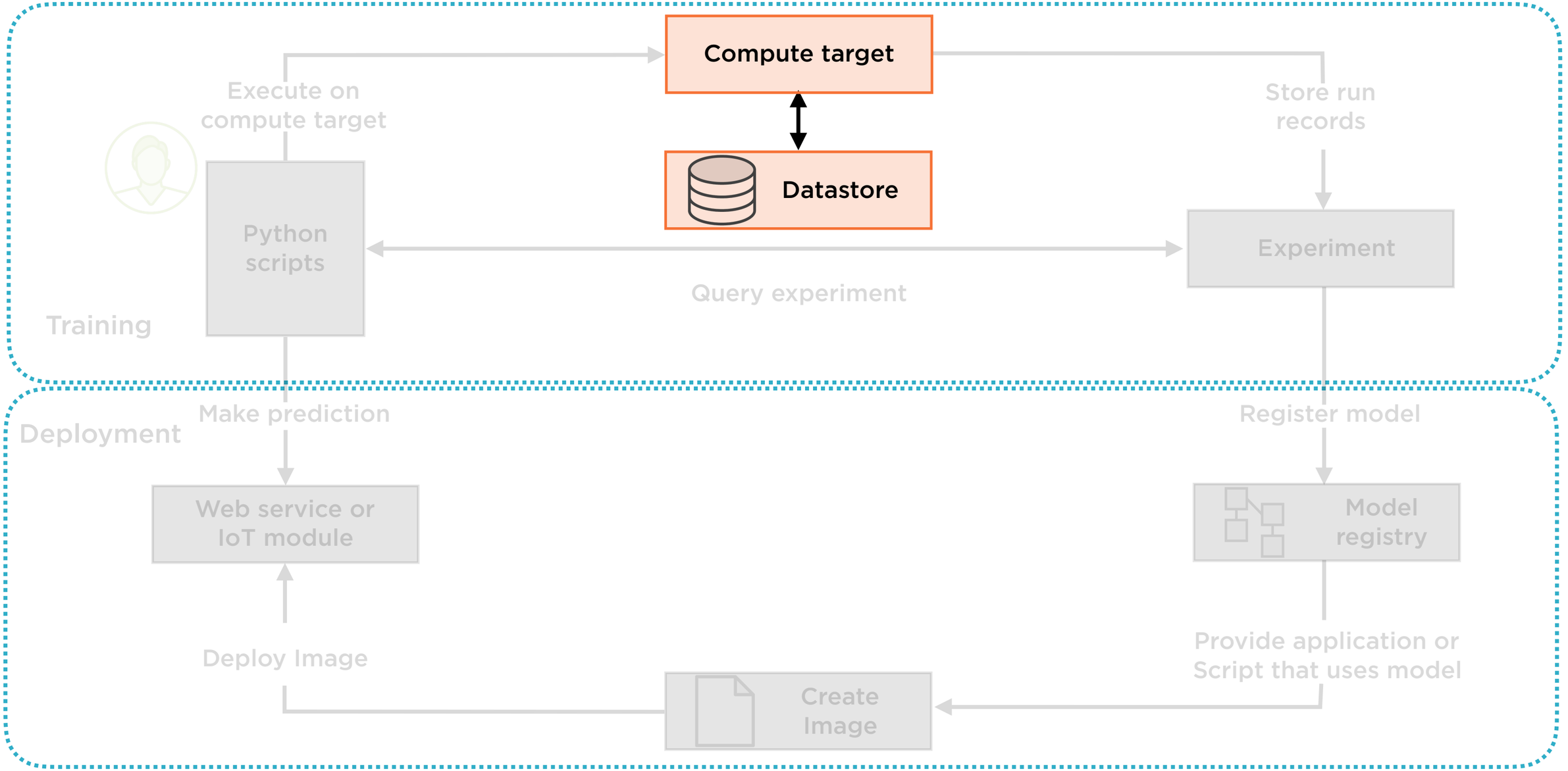
Azure Machine Learning Service



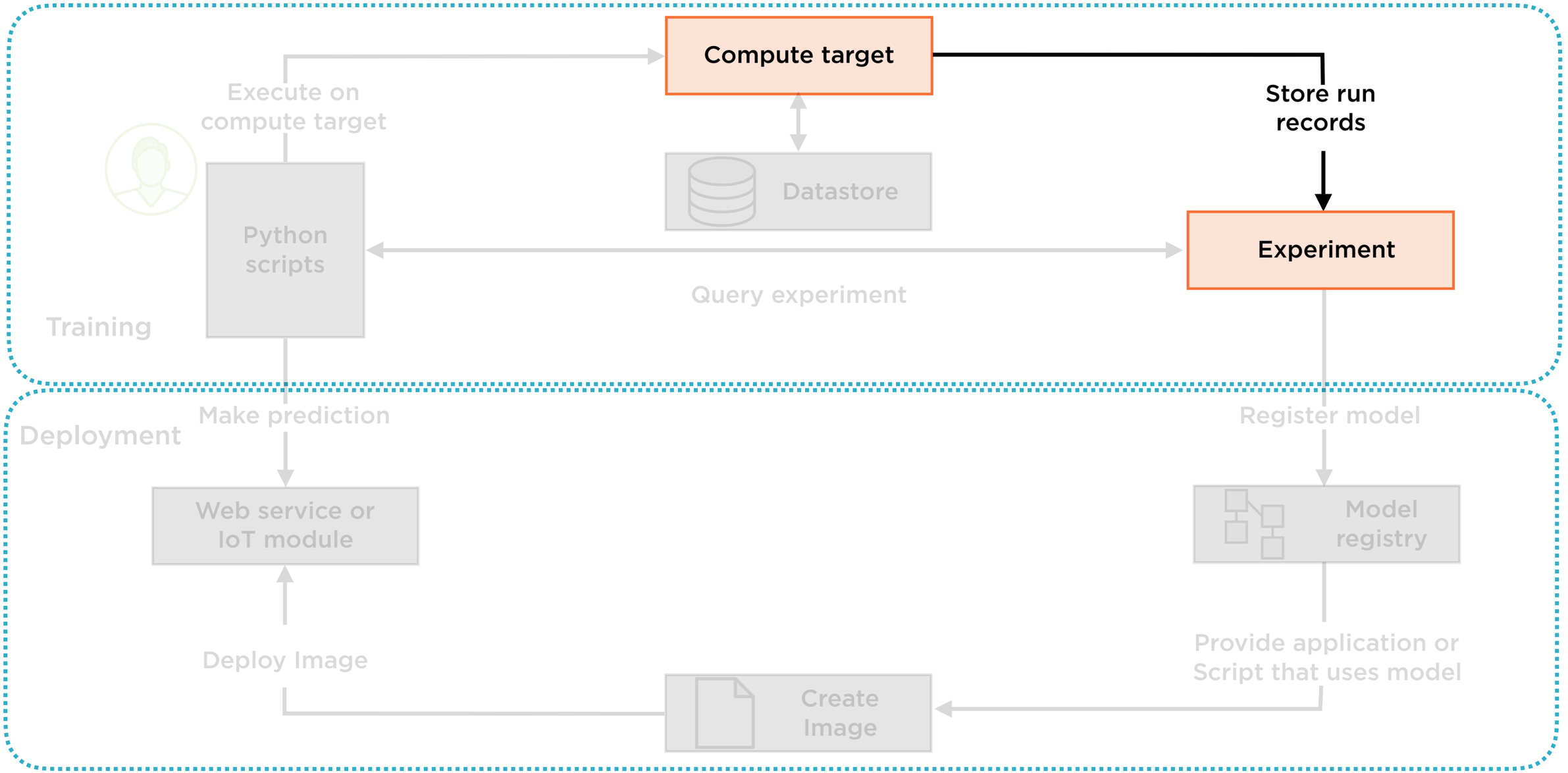
Compute Resources



Storage Abstraction



Groups Runs From the Same Script



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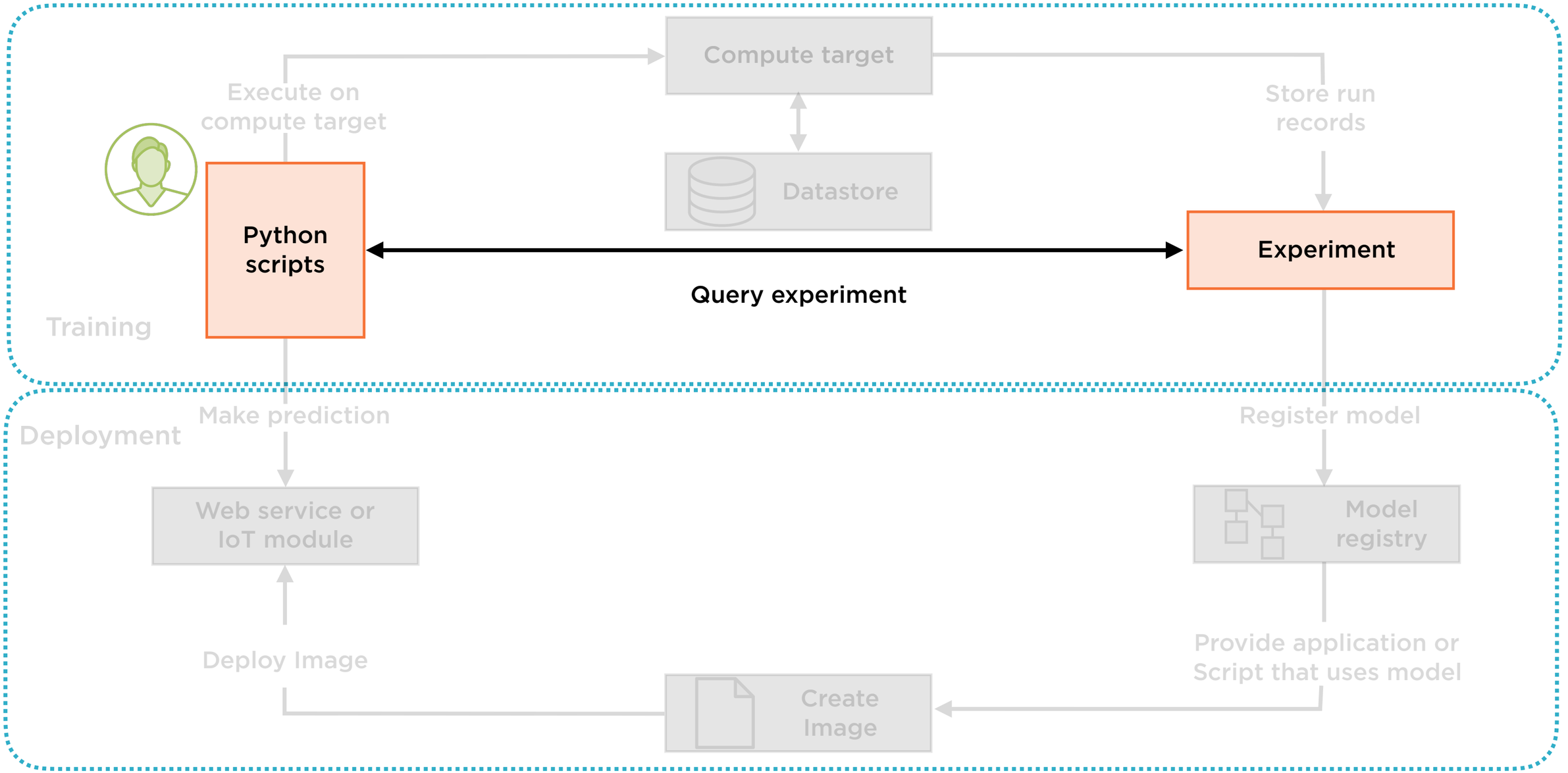
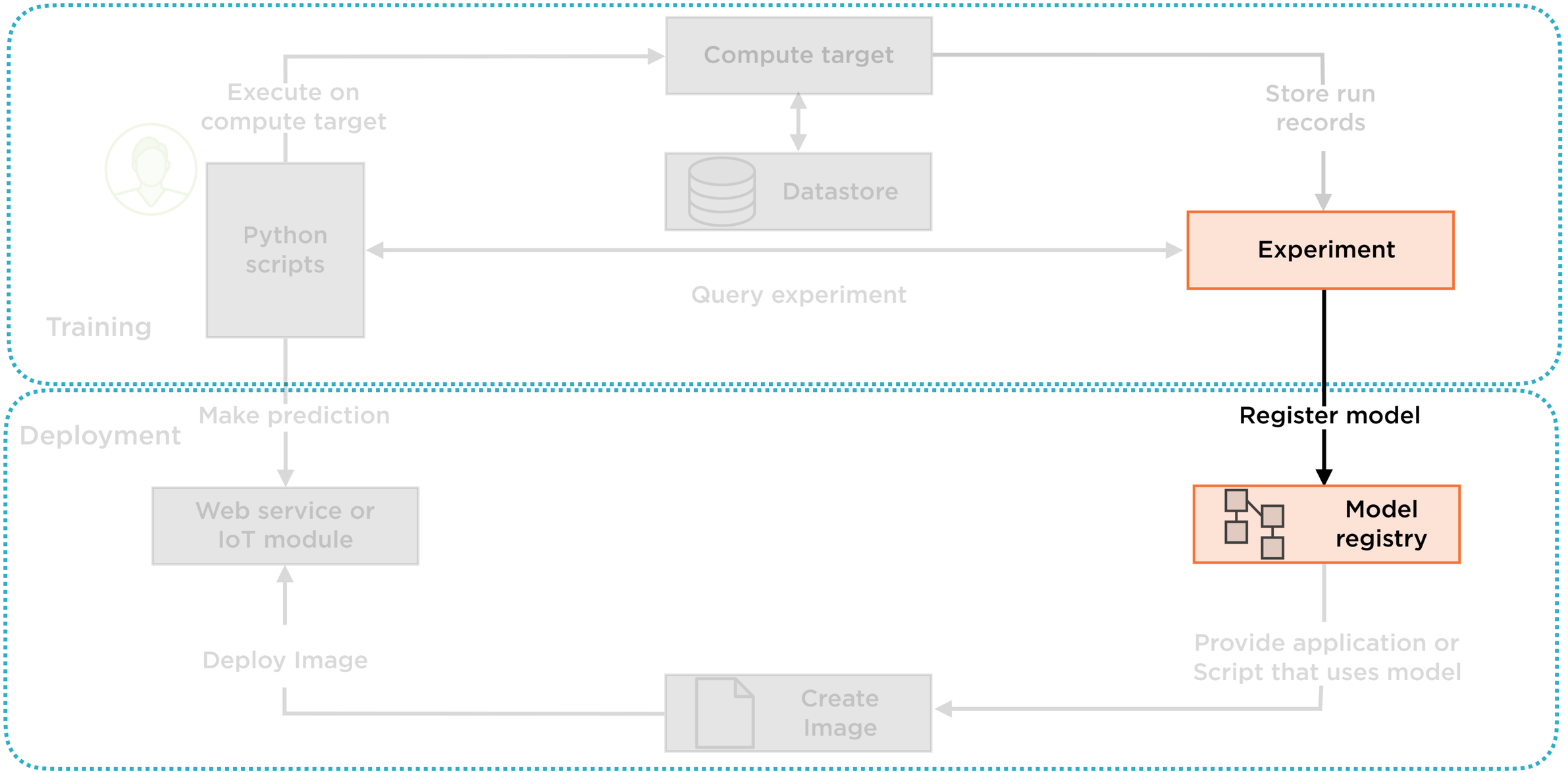


Azure Machine Learning Service



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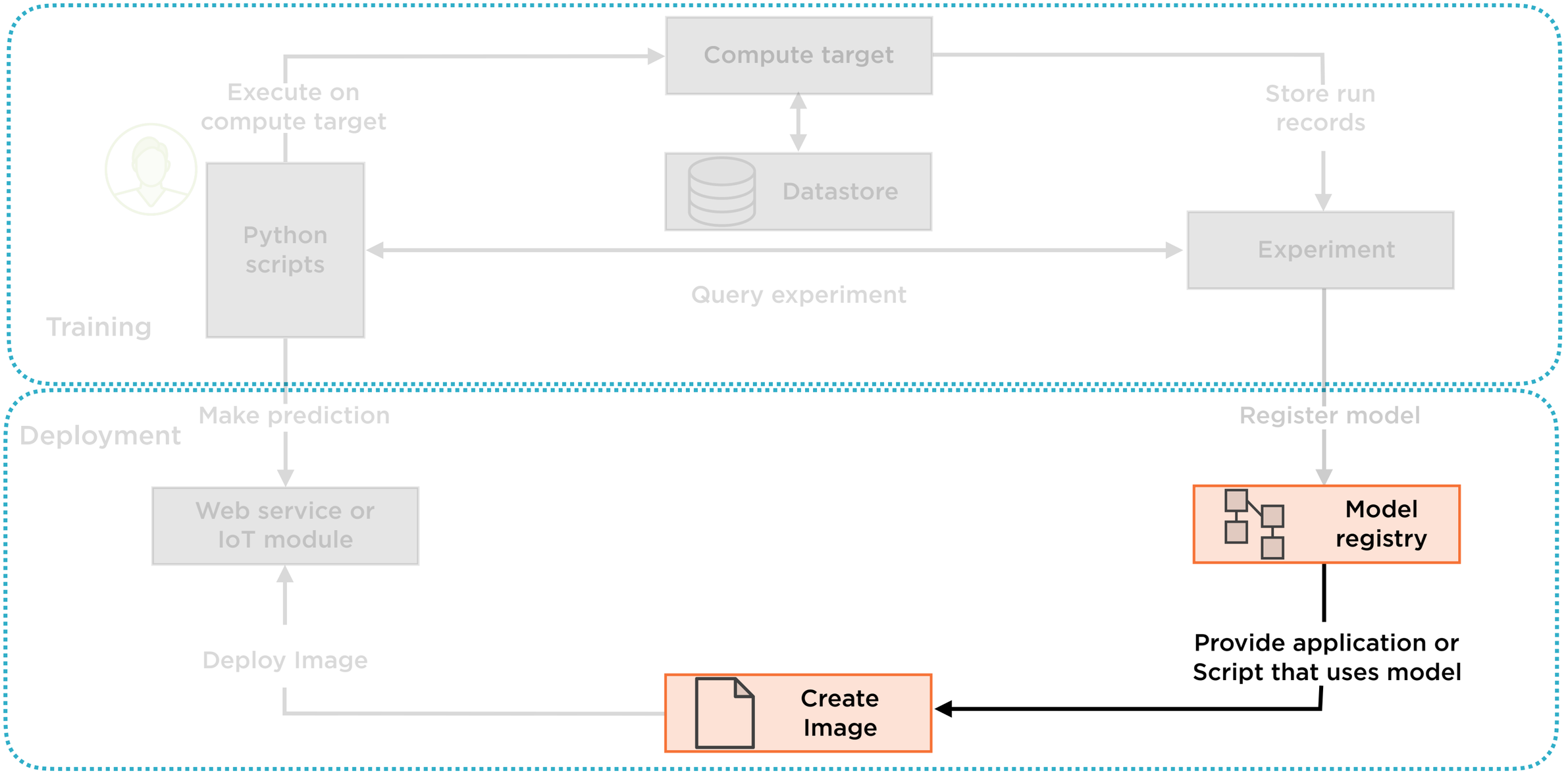

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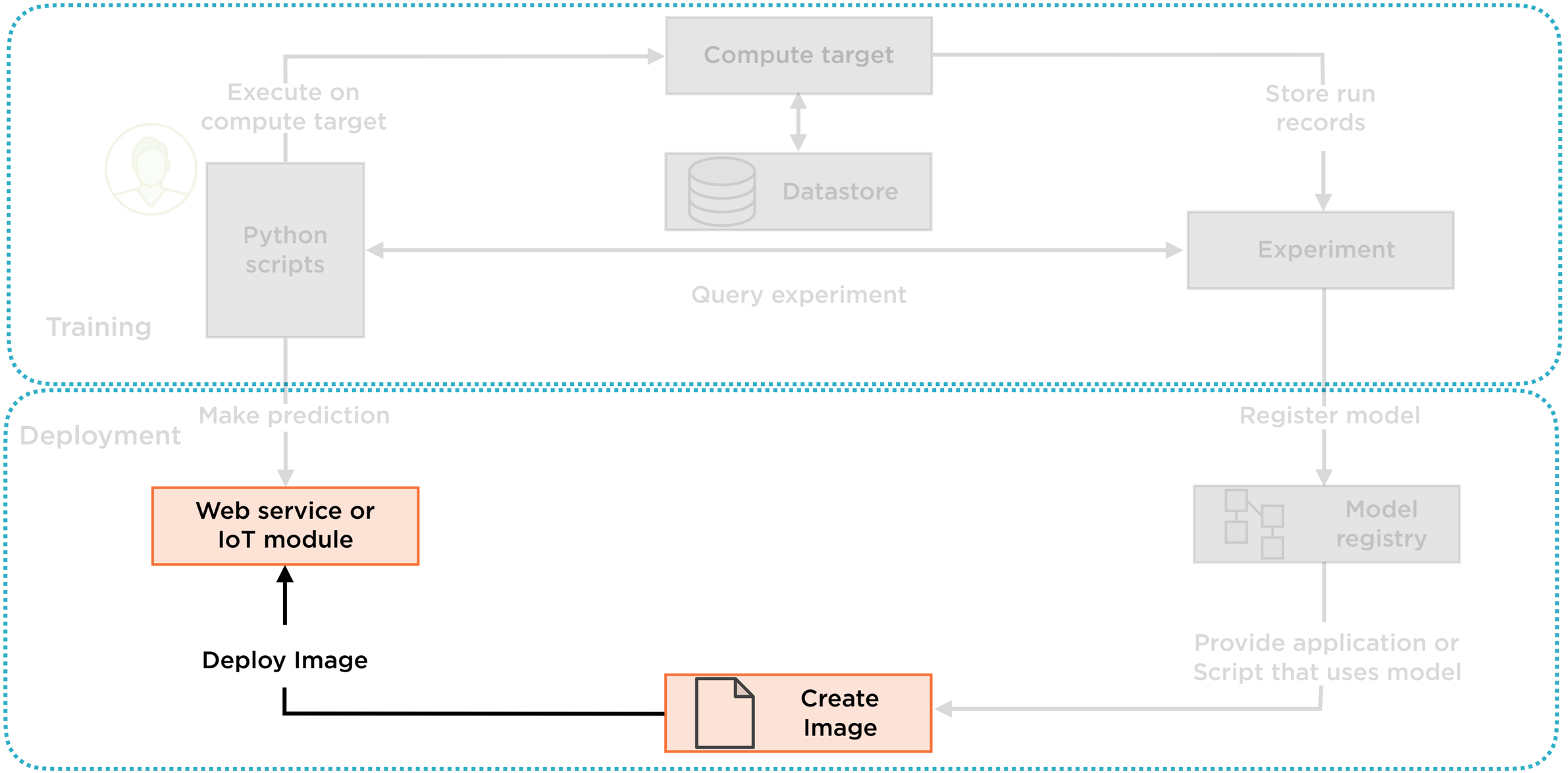

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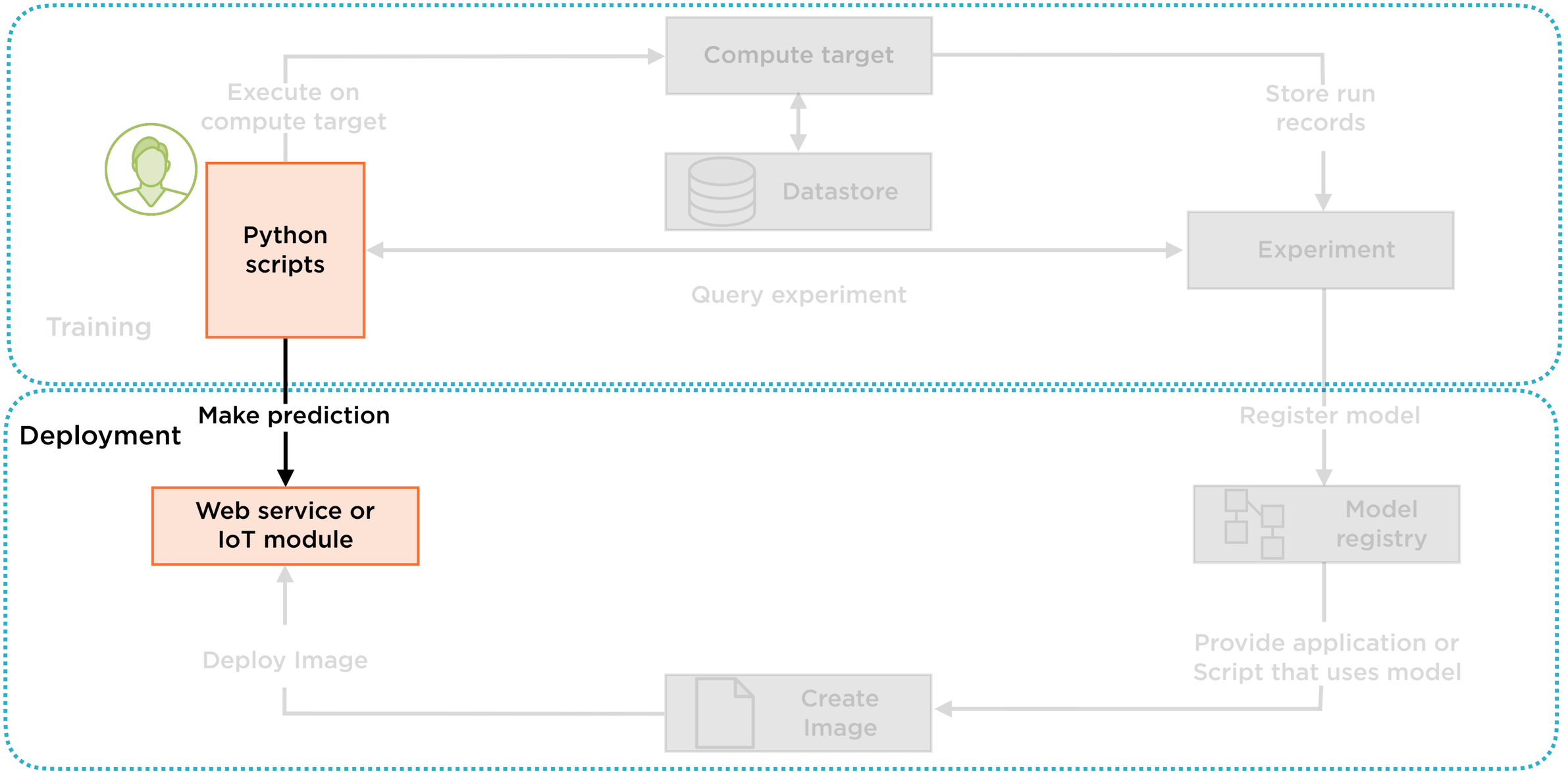


PyTorch Estimators on Azure

PyTorch on Azure Machine Learning

Azure Machine Learning Python SDK

PyTorch, TensorFlow, Chainer estimators

Available for different compute targets

Single Azure VM

GPU Cluster

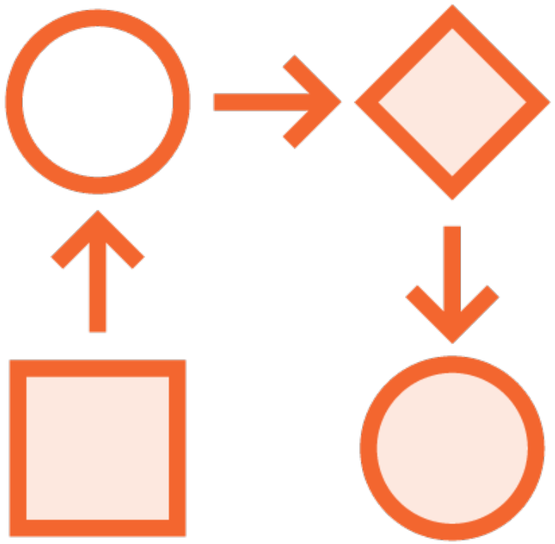
Workspace

Top-level resource in Azure ML service, with list of compute targets, training runs, logs, metrics, and scripts.

Model

In context of Azure ML Service, a trained piece of code that has been registered with the workspace. Training may have been on Azure ML Service, or elsewhere.

Workspaces in Azure ML Service



Register model with workspace

Add scoring script to create image

Deploy image

- Azure container instances
- Azure Kubernetes Service
- RESTful HTTP endpoints

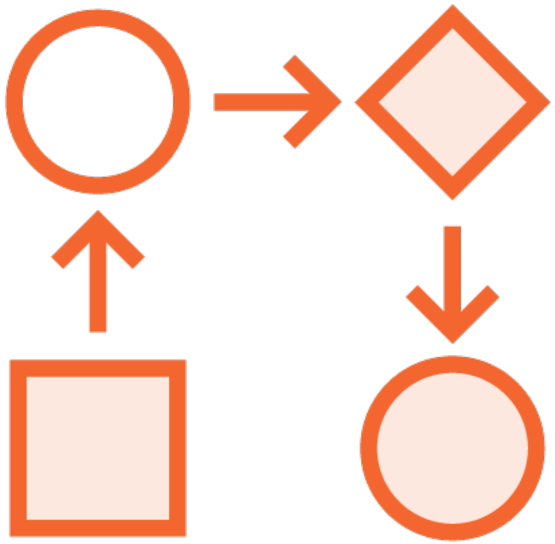
Model Registry

Keeps track of all models registered in a given workspace; maintains model version numbers and metadata as well.

Compute Targets

Compute resources where training scripts are run or models are hosted.

Compute Targets for Training



Local computer

Azure Machine Learning compute

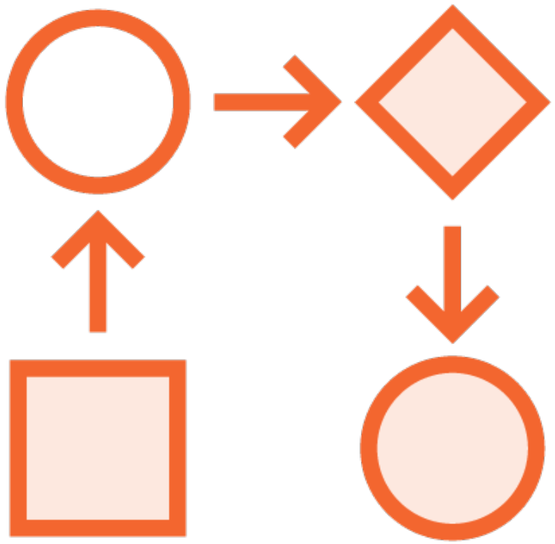
Deep Learning or Data Science VM

Azure Databricks

Azure Data Lake Analytics

Apache Spark for HDInsight

Compute Targets for Deployment



Azure container instances

Azure Kubernetes Service

Azure IoT Edge

HTTP endpoint on FPGA

- Field-Programmable Gate Array
- Project Brainwave

Image

Unit of model deployment. Includes model, scoring script, and dependencies. Azure currently supports Docker images and FPGA images.

Experiment

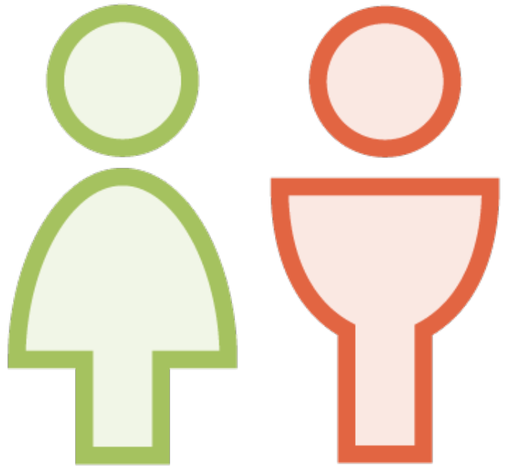
Grouping of many runs of a single script. Contained within a workspace.

Horovod for Distributed Deep Learning

Horovod

Open-source toolkit for distributed training of deep learning models

Horovod

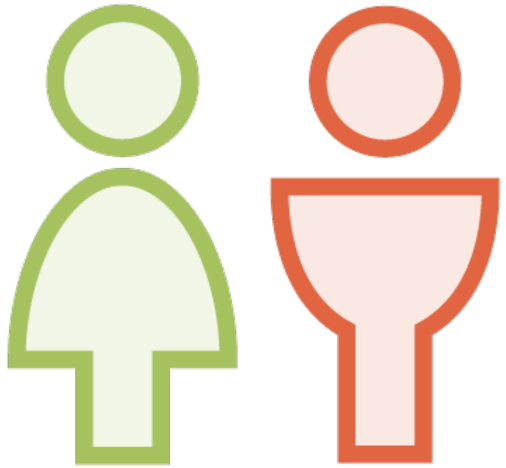


Originated at Uber

Initially for TensorFlow

Now supports PyTorch and Keras too

Horovod

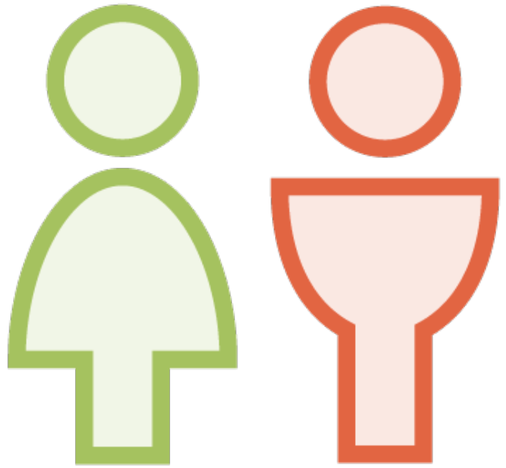


Distributed training on raw TF is notoriously hard

Solutions such as GCP ML Engine are platform-specific

Horovod serves as platform-agnostic solution

Horovod



Gained popularity for ease-of-use as well as speed

Great for large-scale GPU training

Demo

Running distributed training in PyTorch with Azure Estimators and the Horovod framework

Azure Deep Learning VM

Azure Deep Learning VM

Specially configured VM with GPU support

Pre-provided with samples of image and text processing models

Variant of Azure Data Science VM

- Pre-configured with development and visualization tools

Azure Deep Learning VM

Vertical scaling - one powerful VM

Runs on Azure GPU NC-series VMs

Optimized to almost bare-metal

Variant of Data Science VM

- Windows 2016
- Ubuntu

Azure Deep Learning VM

Microsoft Cognitive Toolkit (CNTK)

TensorFlow

Keras

Caffe, Caffe2

MXNet

Torch, PyTorch

The data science and deep learning software is free - you only pay for the underlying VM

Demo

Building PyTorch models on the Azure Deep Learning VM

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